

Abstract

A semiconductor device is formed having a thyristor, a pass device and a conductive shunt that electrically connects an emitter region of the thyristor with a node near an upper surface of the substrate. In one example embodiment of the present invention, the conductive shunt is formed in a trench in a substrate and extending from an upper surface of the substrate to an emitter region of a vertical thyristor, with the emitter region being in the substrate and below the upper surface. In one implementation, the thyristor includes a thyristor body and a control port, with an N+ emitter region of the thyristor body being in the substrate and below and upper surface thereof. A pass device is formed adjacent to the thyristor, and the conductive shunt is formed in a trench extending from the N+ emitter region to a source/drain region of the pass device. With this approach, thyristor applications can be implemented having an emitter region in a substrate and not necessarily directly accessible, for example, via an upper surface of the substrate. This approach is also useful, for example, in applications where a cathode-down thyristor is used, such as when it is desirable to form the thyristor control port near a bottom portion of the thyristor, and in high-density circuit applications, such as memory arrays.